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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 10/578,265 | 07/03/2006 | Shahab Jahromi | 4662-182 | 1954 |

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| EXAMINER | |
|---|---|
| RAYMOND, BRITTANY L | |

| ART UNIT | PAPER NUMBER |
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| 1795 | |

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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/578,265 | JAHROMI ET AL. | |
| | Examiner | Art Unit | |
| | BRITTANY RAYMOND | 1795 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *29 January 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1,3-8,11-13,16 and 18-48* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3-8,11-13,16 and 18-48* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *04 May 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

2. Claims 1, 3-8, 13, 18-24, 27, 29 and 43-48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Garito (U.S. Patent Publication 2003/0175004) in view of Taketo (JP Publication 10-340846) and Vogel (U.S. Patent Publication 2004/0257544).

Garito discloses optical polymer nanocomposites comprising inorganic nanoparticles in a matrix. Garito states that the inorganic nanoparticles have index of refraction values between about 1 and 4 and that they can be used to make the index of refraction of the nanocomposites from about 1 to 5 (Paragraphs 0104 and 0105), as recited in claims 1, 5, 6, 22, 43 and 46 of the present invention. Since the range of values of the index of refraction is so large, it would be obvious that the index of refraction can be changed by at least 1% using the nanoparticles, and that the

nanoparticles could be added to an amount that the nanocomposite has the same refractive index as the nanoparticles, as recited in claims 1, 13, 27 and 43 of the present invention. Garito also discloses that nanoparticles have a size from about 10 nm to about 500 nm, and can be as small as 1 nm (Paragraph 0004), as recited in claims 7, 8, 23 and 24 of the present invention.

Garito fails to disclose that the nanoparticles are added to an immersion fluid for an immersion lithography process, that the exposure is performed using light at a wavelength of 193 nm, that the immersion fluid is recycled through the system and cleaned, and that the immersion fluid is an alkane, and that the alkane comprises 6 to 10 carbon atoms.

Taketo discloses an immersion lithography process and exposure apparatus comprising: a refractive index adjusting device that increases the amount of an additive that is provided in the immersion liquid in order to increase the refractive index to that of the additive, and a recycling system that is used to recycle the immersion liquid used in the exposure process (Paragraphs 0026-0032), as recited in claims 1, 3, 13, 16 and 43 of the present invention. Since the amount of additive is being monitored, it would be apparent that the amount of additive present can either be very small or large, as recited in claim 4 of the present invention. Taketo also discloses that a 193 nm exposing light can be used (Paragraph 0020), as recited in claims 1, 29 and 43 of the present invention.

Vogel discloses that the immersion fluid for a 193 nm imaging is preferably water, or can be a cyclo-octane (Paragraph 0048), as recited in claims 18-21, 30, 32, 44, 45,

47 and 48 of the present invention. Vogel also discloses that increasing the refractive index of the system enables enhanced resolution by lowering the effective wavelength of light (Paragraph 0005). Vogel states that an increased refractive index can push 193 nm lithography down to 145 nm (Paragraph 0006).

It would have been obvious to one of ordinary skill in the art, at the time of invention by applicant, to have placed the nanoparticles of Garito in an immersion fluid, as suggested by Taketo, because Taketo teaches that the index of refraction of an immersion fluid is important and can be altered by placing additives in the fluid. Vogel also teaches that an increased index of refraction allows for improved resolution of the optical system and a more accurate photoresist pattern to be formed. It also would have been obvious to one of ordinary skill in the art, to have used alkane as the immersion fluid of Garito, as suggested by Vogel, because Vogel teaches that cyclo-octane is a common immersion fluid for producing accurate photoresist patterns in 193 nm exposures.

3. Claims 16, 28, 30-39 and 42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Garito (U.S. Patent Publication 2003/0175004) in view of Taketo (JP Publication 10-340846) and Vogel (U.S. Patent Publication 2004/0257544) as applied to claims 1, 3-8, 13, 18-24, 27, 29 and 43-48 above, and further in view of Sewell (U.S. Patent 6809794).

The teachings of Garito, Taketo and Vogel have been discussed in paragraph 2 above. Garito, Taketo and Vogel teach every limitation of dependent claims 31-39 and 42 of the present invention in paragraph 2 above.

Garito, Taketo and Vogel fail to disclose that after the production of the microchip, the immersion fluid is transported to a cleaning unit, cleaned, and recycled into the process for producing the chips.

Sewell discloses an inverted immersion photolithography system comprising: a projection optical system placed below the wafer to be processed, a housing around the lens of the optical system, and a liquid filled between the top of the housing and the lens of the optical system (Column 3, Lines 30-53). Sewell also discloses that the liquid can be filtered, temperature controlled and recycled back into the region between the lens and wafer (Column 4, Lines 23-32), as recited in claims 16, 28 and 30 of the present invention.

It would have been obvious to one of ordinary skill in the art, at the time of invention by applicant, to have cleaned and recycled the immersion liquid back to the region above the wafer, as suggested by Sewell, in the process of Garito, Taketo and Vogel because Sewell teaches that this technique is more efficient and helps to maintain an appropriate composition and temperature of the immersion fluid.

4. Claims 11, 12, 25 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Garito (U.S. Patent Publication 2003/0175004) in view of Taketo (JP Publication 10-340846) and Vogel (U.S. Patent Publication 2004/0257544) as applied to claims 1, 3-8, 13, 18-24, 27, 29 and 43-48 above, and further in view of Pohl (U.S. Patent 5618872).

The teachings of Garito, Taketo and Vogel have been discussed in paragraph 2 above.

Garito, Taketo and Vogel fail to disclose that the nanoparticles comprise an Al 3+ compound, or fused amorphous SiO2, MgO, nanodiamond, and/or MgAl2O4.

Pohl discloses inorganic fillers for changing refractive index values of organic matrix materials. Pohl states that the inorganic fillers can comprise SiO2 or Al2O3 (Column 2, Lines 30-36), as recited in claims 11, 12, 25 and 26 of the present invention.

It would have been obvious to one of ordinary skill in the art, at the time of invention by applicant, to have used the nanoparticles of Pohl in the process of Garito, Taketo and Vogel because Pohl teaches that these compounds have high refractive index values and can increase the refractive index of a surrounding matrix.

5. Claims 40 and 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Garito (U.S. Patent Publication 2003/0175004) in view of Taketo (JP Publication 10-340846), Vogel (U.S. Patent Publication 2004/0257544) and Sewell (U.S. Patent 6809794) as applied to claims 16, 28, 30-39 and 42 above, and further in view of Pohl (U.S. Patent 5618872).

The teachings of Garito, Taketo, Vogel and Sewell have been discussed in paragraphs 2 and 3 above.

Garito, Taketo, Vogel and Sewell fail to disclose that the nanoparticles comprise an Al 3+ compound, or fused amorphous SiO2, MgO, nanodiamond, and/or MgAl2O4.

Pohl discloses inorganic fillers for changing refractive index values of organic matrix materials. Pohl states that the inorganic fillers can comprise SiO2 or Al2O3 (Column 2, Lines 30-36), as recited in claims 25, 26, 40 and 41 of the present invention.

It would have been obvious to one of ordinary skill in the art, at the time of invention by applicant, to have used the nanoparticles of Pohl in the process of Garito, Taketo, Vogel and Sewell because Pohl teaches that these compounds have high refractive index values and can increase the refractive index of a surrounding matrix.

***Response to Arguments***

6. Applicant's arguments, filed 1/29/2009, have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of a newly found prior art reference.

Applicant argues that Garito is in an art that is non-analogous to that with which the present invention is concerned and cannot be combined with Taketo to teach the limitations of the claims of the present invention. Applicant specifically argues that Garito teaches placing nanoparticles in a polymeric matrix which would be different from placing nanoparticles in an immersion fluid. Garito teaches that the nanoparticles increase the refractive index of the composite material closer to the refractive index of the particles. It would be known by one of ordinary skill in the art that if a material of high refractive index is placed in a host material of low refractive index, the composite material will be increased from that of the host material, regardless of the type of matrix material.

Applicant also argues that Garito teaches that the addition of nanoparticles to the host matrix is detrimental to the optical loss. Garito teaches that in order to prevent optical loss, the nanoparticles must be made smaller so that they do not interfere with

the light and more nanoparticles can be added into the matrix to increase the refractive index.

Applicant argues that the refractive index of Garito is controlled in order to optimize the transfer of light across a spectrum of wavelengths, which is in direct contrast to the present invention, which increases refractive index to improve image resolution at a single 193 nm wavelength. Garito is relied upon to teach that an increase refractive index can optimize the transfer of light through a medium. Taketo teaches that immersion photolithography is performed with a single wavelength of light. It would have been obvious to one of ordinary skill in the art that if the nanoparticles of Garito were placed in the immersion fluid of Taketo, the refractive index of the immersion fluid would be increased to optimize transfer of light through the fluid.

Regarding Taketo, Applicant argues that this reference does not teach the importance of a high index of refraction for immersion fluids. Vogel has been combined with Garito and Taketo to teach the importance of a high refractive index in the area between a final lens of the exposure system and the wafer. Vogel teaches that a high refractive index can push a 193 nm lithography down to 145 nm, which produces a finer photoresist pattern.

Finally, Applicant argues that the exposure system of Taketo does not teach cleaning and recycling the immersion fluid, but rather teaches recycling a gaseous output from the system. The reference, Sewell, has been added to teach that in a common immersion photolithography system, an immersion fluid can be filtered, temperature controlled and recycled back between the final lens and the substrate.

The reference, Pohl, teaches every limitation of the dependent claims 11, 12, 25, 26, 40 and 41 of the present invention.

***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to BRITTANY RAYMOND whose telephone number is (571)272-6545. The examiner can normally be reached on Monday through Friday, 8:30 a.m. - 5:00 p.m. EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on 571-272-1385. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

**/Kathleen Duda/**
**Primary Examiner, Art Unit 1795**

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